DOVER FOOD RETAIL

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White Paper

Get the Right Case for the Job

Making the right decisions on major expenditures, such as the refrigerated display cases used to store and display perishable food products, can have a significant impact on your store's operational performance and profitability.

Decisions … decisions … decisions. So often in business and our personal lives we are faced with decisions whose outcome could have a significant impact on us based on making the right choice up front. The retail food business is certainly not immune from this. Which food products will you offer for sale; what promotions will you conduct and when; how do you want your store laid out; what is your brand message and what décor will best convey it, and the list goes on and on. Making the right decisions on major expenditures, such as the refrigerated display cases used to store and display perishable food products, can have a significant impact on your store's operational performance and profitability.

So, the question becomes, if the task at hand is storing and displaying perishable products, such as meat, poultry and seafood, what is the right case technology for the job? It's always good to have some verifiable facts when making those ever-important decisions to validate your choice and give you confidence that you made the right move. A recent research work[1] currently under peer-review in the journal, *Food Control*, offers some valuable insight as to which refrigerated display case technology has the upper hand when it comes to storing and displaying beefsteaks and chicken breasts.

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[1] Food Control: Evaluation of Shelf Life and Quality of Beef Steaks and Chicken Breasts in Refrigerated Display Cases Using Four Unique Cooling Technologies; completed by the Polymer and Food Protection Consortium at Iowa State University, 2018

The objectives of the *Food Control* study were:

1. Determine the effect of refrigerated display case type on the shelf life and microbial load of beefsteak and chicken breasts, and;
2. Evaluate the effect of a gravity coil conductive cooling case vs. complete conductive cooling case on the growth of *Escherichia coli* K12 artificially-inoculated onto beef steak.

Shelf life[2] is defined as the time a food product retains its desired sensory, chemical, and physical characteristics while also remaining safe for consumption. Bacteria associated with meat spoilage produce off-odors and flavors, tissue discoloration, gas, and slime. This can cause a variety of adverse issues for a food retailer, not the least of which is a loss of sales revenue.

Beefsteaks and chicken breasts were placed for 5 and 8 days, respectively, in four types of commercially-available refrigerated display cases utilizing either convective, conductive, or a combination of the two cooling technologies. Bacterial counts on meat surfaces, meat color, internal meat temperature, case temperature, case relative humidity and product weight loss were assessed daily for all four selected types of the refrigerated display cases.

Specifically, the four refrigerated display case technologies involved in the ISU study were:

1. Conduction Cooling Gravity Assist Service Case (CCGA)
2. Gravity Coil Service Case with Partial Conduction Coil Base Deck (PCC)
3. Gravity Coil Service Case with Serpentine Assist (GSA)
4. Blower Coil Service Case with an Additional Fogging System (BCF)

[2] Sun and Holley, 2012; Delmore, 2009

Let's take a closer look at these four technologies and how the basis of their design works to cool the product displayed. A **Conduction Cooling Gravity Assist Service Case** (CCGA) removes heat by direct transfer, or conduction, of heat from one surface to another. When two objects or surfaces are in contact, heat will flow from the warmer surface to the cooler surface until both are at nearly the same temperature. Conduction heat transfer in a CCGA display case type is through circulating chilled coolant utilizing non-ozone depleting/non-global warming chilled coolant. This occurs through a single heat transfer surface via glycol-filled channels located in the aluminum deck pans where the product is displayed. This process allows for even cooling. The glycol flow in deck pans utilizes pulse-flow control, freezing and thawing moisture on the deck pans as their temperature cycles between set points of -1.7 °C (29 °F) and 0.6 °C (33 °F). A small, top, gravity coil assists in tempering the air and keeping natural circulation and humidity within the display case. This case also utilizes a pulse-flow control just like the deck pans. With conduction cooling, the air above the product is just tempered since the majority of the refrigeration is being done directly with the product.

A **Gravity Coil Service Case with Partial Conduction Coil Base Deck** (PCC), where most of the refrigeration is done with the top gravity coil, removes heat through a combination of convection and conduction cooling. A gravity coil in the top of the display case is designed to keep product cold through natural convection heat transfer. Refrigerant runs through the gravity coil and absorbs heat from the air. The cooled air falls from the top coil and cascades around the product, removing heat in the process. The difference in temperature between the cooled air and the warmer product results in heat being transferred from the product to the air

flowing through the cavity of the service case. This type of display/service case also utilizes partial conduction cooling through means of a covered, serpentine deck coil. Refrigerant flows through a spiral copper coil and then transfers heat through the metal deck to the coil.

A **Gravity Coil Service Case with Serpentine Assist** (GSA), cools through convection utilizing a top gravity coil and lower serpentine coil. A gravity coil located in the top of the display case is designed to keep the product cold through convection heat transfer. Most gravity convection cooling is designed for HFC/HFO refrigerants to run through the gravity coil where they absorb heat from the air. The cooled air falls from the top coil and cascades around the product, removing heat in the process. The difference in temperature between the cooled air and the warmer product results in heat being transferred from the product to the air flowing through the cavity of the service case. This type of display/service case also utilizes an assist by cooling through means of a serpentine base deck coil as well. Chilled refrigerant flows through copper piping under the deck pans to enhance refrigeration and help keep the underside of the product cool.

A **Blower Coil Service Case with an Additional Fogging System** (BCF) consists of a forced air blower coil underneath the deck area of the display case. It is designed to keep product cold through forcing air through a coil for the heat transfer. A fogging system is utilized to help add moisture back into the environment to supplement the moisture loss that often results from the air flowing over the product.

So, which refrigerated display case technology came out on top when it comes to best maintaining the product integrity and product safety of beefsteaks and

chicken breasts? Looking at the specifics of the study results, the coldest product tissue temperatures were observed for steaks and chicken breasts placed in the CCGA (Conduction Cooling Gravity Assist Service Case) display case while the warmest tissue temperatures tended to occur when the cuts were placed in the PCC (Gravity Coil Service Case with Partial Conduction Coil Base Deck) case. The CCGA case had 2.95 °F (1.64 °C) cooler product tissue temperature than the PCC case. Putting this in perspective, although the number may not seem big at first sight, an approximately 3 °F differential in meat product temperature is very significant when it comes to pathogen modeling[3] and the growth potential of harmful microorganisms (bacteria).

Besides the notable advantage of lower product tissue temperature, the CCGA conduction cooling case realized benefits from its ability to keep relative humidity at properly elevated levels and minimize decreased product weight due to moisture losses. The steaks lost more weight when held in the PCC case and therefore exhibited a higher product shrinkage. By day 8, steaks held in the PCC case had lost 10.8% of their weight compared to 9.7% for steaks held in the CCGA case. Steaks lost more weight each day they were held in the PCC case than the CCGA case except on day 8, where steaks in both cases lost the same amount of weight. Weight loss from meat is an important economic factor because meat is sold on a basis of unit weight. The larger weight loss for steaks in the PCC display case is attributed to a lower relative humidity resulting from a more rapid circulation of air within the display case. These results agree with overall relative humidity measurements taken daily in the four display cases where the lowest RH

[3] Pathogen Modeling, University of Wisconsin, 2009

consistently tended to occur in the PCC case.

In summary, the *Food Control* study concluded that the Conduction Cooling Gravity Assist Service Case (CCGA) utilizing pulse-flow coolant control was superior to the other three case design technologies studied in its ability to create a favorable climate for the product integrity and safety of meat products.

So, when it comes to making that decision on just which refrigerated display case technology is right for the job and would best meet your needs of storing and displaying perishable foods, such as meat, poultry and seafood, look no further. Research has now validated that the answer is the Conduction Cooling Gravity Assist Service Case (CCGA).